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University of Kentucky

The Relation of Time of Cutting to Leafhopper Injury to Alfalfa.

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The Relation of Time of Cutting to Leafhopper Injury to Alfalfa.

By H. H. JEWETT

Injury by the leafhopper, *Empoasca fabae,* causes alfalfa to turn yellow, and lessens the yield. The yellowed alfalfa hay has less sales value, because it lacks the green color of better grades of hay. Analyses of yellowed alfalfa[1] indicate that yellowed leaves are lower in protein than normal leaves, while the stems show no such difference. Before it was learned that the yellowing was caused by leafhopper injury, the general recommendation was to cut alfalfa when it became stunted and yellowed. However, cutting at this stage did little more than check the yellowing temporarily, especially when the second cutting was made during the first half of July.

Normally, at the time of the first cutting of alfalfa there has been little or no injury by hoppers, but by the time of the second crop, and sometimes the third, hoppers are present in numbers, and the injury is severe. There is no insecticide that can be used economically for controlling the insect in fields of alfalfa, but the injury can be lessened to a certain extent and confined mainly to one crop, provided the cutting dates are planned to coincide with certain stages in the seasonal development of the insect. During the seasons of 1932 and 1933 experiments were carried out to get information that could be used to determine a procedure for decreasing the amount of injury by this insect.

Method of Procedure. The alfalfa used in these tests was grown in cages so that insects other than the leafhopper could be excluded. Each cage enclosed a row of alfalfa ten feet long,

[1] Ohio Agricultural Experiment Station, Department of Agronomy, Mimeograph Report No. 12, pp. 139-140, 1931.

and there was sufficient room for the complete development of the plants. The alfalfa in half of the cages was infested by the leafhoppers and in the other half, was free from leafhoppers. For each test, there was one plot of infested alfalfa and one plot of uninfested alfalfa; some of the tests were run in duplicate. The alfalfa used in 1932 was in its first season's growth and that in 1933 the second season's growth.

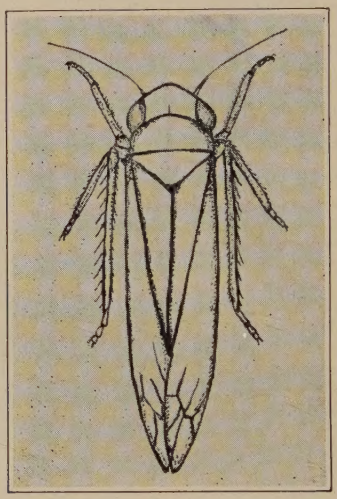

Fig. 1. The leafhopper, Empoasca fabae, is a slender, pale green insect about one-eighth of an inch long.

In 1932, the alfalfa of each plot was cut two times, 45 days apart. The first cutting dates extended at intervals of a few days thru the last three weeks of July, in order to determine the date for the next cutting when the alfalfa would be least injured. The dry weights of the alfalfa at each cutting and for each test were recorded. The first and second cutting dates of the 1932 season's tests corresponded to the second and third cutting dates of the 1933 season's tests.

In 1933, the alfalfa of each plot was cut three times about 45 days apart. The tests were so arranged that the first cuttings were made at intervals of a new days during the first half of June and the second cuttings at intervals of a few days during the last three weeks of July. The dry weights of the alfalfa for each cutting were recorded.

THE RELATION OF THE DEVELOPMENT OF THE LEAFHOPPER TO THE TIME OF CUTTING ALFALFA

It is especially necessary to consider two stages in the seasonal development of the leafhopper when deciding upon cutting dates for alfalfa. The first of these stages is the time of the appearance in the spring of adult hoppers in numbers and the second, the time of the appearance of the maximum numbers of hoppers later in the season. Observations in the field during the seasons of 1928 to 1933 show that adult hoppers appear in numbers in the spring about June 1, and are most numerous about July 25.

The adults lay some of their eggs in the first crop of alfalfa and these are destroyed when the crop is cut. When the cutting is delayed until near the full-blooming stage, the adults will have laid a large part of their eggs and there will be fewer leafhoppers on the second crop.

It is not possible to set an exact date for cutting the first crop, but from field observations on the development of the leafhopper, the first cutting should be made on June 10 to June 15. In the spring of 1929, young hoppers were appearing in considerable numbers on June 14 on the first crop of alfalfa in the field. In this instance, the alfalfa should have been cut a little before that date. Alfalfa should be cut the second time when the hoppers have reached their maximum numbers and are beginning to decline. This takes place during the last week of July. By delaying the second cutting, very little damage will be done to the third crop, because the hoppers decrease rapidly in number after August 1. If the second crop has become yellowed, little additional damage can be done by delaying the cutting a few days longer.

CONDITION OF THE ALFALFA AT THE CUTTING DATES

Yellowing began in 1932 before July 11, when the first cutting was made, and by July 21, the alfalfa was almost completely yellowed. The infested alfalfa had a dwarfed appearance by July 21 and thru the rest of July made practically no growth. The growth of the uninfested alfalfa was better than that of the infested alfalfa thru the entire season. The growth of the infested alfalfa after the cuttings made on July 11, 16,

and 21 was not quite as good as that made after the July 25, 28, and August 1 cuttings. There was very little yellowing of the alfalfa after cuttings made on July 25 and later.

There was practically no injury by leafhoppers to the first crop in 1933. The alfalfa was in nearly one-fourth bloom by June 2 and in nearly full bloom by June 15, when the earliest and latest first cuttings were made. The dwarfing and yellowing of the second crops, following cuttings made on June 2 and

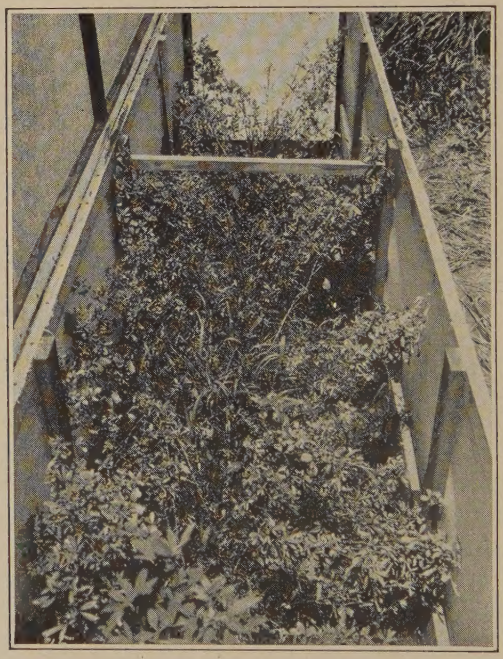

Fig. 2. A third crop of alfalfa injured by leafhoppers, as a result of reinfestation following a second cutting too early in July.

June 5, was much more pronounced than that of the second crops, following cuttings made on June 13 and June 15.

Injury to the third crop, following second cuttings made on July 10, 15, and 20 was greater than that to the third crop following second cuttings made on July 28 and 31. There was some slight yellowing of the leaves in the third crop even when the second cuttings were made on July 28 and 31, but as the season advanced, the yellowing gradually disappeared.

RESULTS OF EXPERIMENTS

Experiments in 1932. The results of the tests for this year are summarized in Table 1. The alfalfa was of the first year's growth and injury by the hopper was generally severe. The yield from each infested plot was compared with that of its check or uninfested plot. The result of cutting early in July is shown in the heavy reduction in yield of the next crop. There was in

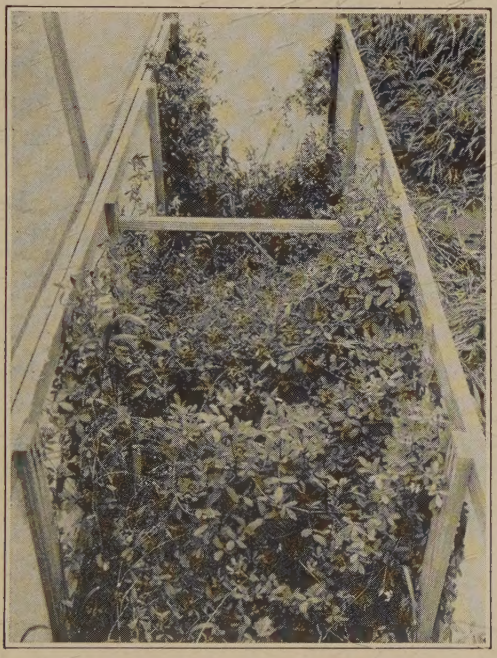

Fig. 3. A third crop of alfalfa showing no injury by leafhoppers, following a second cutting made during the last week of July.

general a slight decline in the reduction of yields following successively later cuttings in July. The reduction in yield following the August 1 cutting was 13 percent less than the reduction in the yield following the July 11 cutting. The July 11 cutting was made too early and re-infestation of the alfalfa took place after that date. The seasonal reduction in yields was practically the same for each individual test. This was probably due to the lack of a first cutting because of the age of the plants.

Experiments in 1933. The results for this year's tests are summarized in Table 2. Records of three cuttings for each test

are given. The effect of cutting the first crop near the first of June and at the middle of June is shown by the difference in the reduction in yields of the second crop. The reduction in yield of a second crop following a first cutting on June 15 was 10 percent less than the reduction in yield of a second crop following a first cutting on June 2. The reduction in yields of the second crops following cuttings made on June 9 and June 13 also were less than those following first cuttings made earlier than June 9.

The reduction in yields of third crops following cuttings made on July 10 to July 20 were greater than those following cuttings made on July 28 and July 31. When second cuttings were made on July 10 to July 20 the alfalfa for the third crop was injured severely, but when cuttings were made on July 28 and later, there was very little injury to the third crop.

The reduction in the season's yield was less when the first cuttings were made near the middle of June and when the second cuttings were delayed till the later part of July, than when the first cuttings were made near June 1 and the second cuttings were made July 20 or earlier. The quality of the third crop of hay was also much better when first and second cuttings were delayed because there was very little yellowing of the leaves of the third crop.

TABLE 1. SUMMARY OF RESULTS OF TESTS FOR 1932

Date Cut	Infested Plots	Height When Cut Inches	Dry Weight Grams	Check Plots	Height When Cut Inches	Dry Weight Grams	Reduction in Yield	
							Cutting Percent	Season Percent
July 11	2	16	225	1	21	335	32.9	
Aug. 25	2	16	210	1	26	380	44.7	39.2
July 16	4	17	240	3	26	360	33.3	
Aug. 30	4	16	260	3	32	455	42.9	38.7
July 21	6	20	295	5	31	460	35.9	
Sept. 5	6	18	310	5	32	500	38.0	37.0
July 21	8	20	265	7	31	450	41.1	
Sept. 5	8	18	345	7	31	550	37.3	39.0
July 25	10	20	235	9	31	465	49.5	
Sept. 8	10	22	250	9	31	380	34.2	42.6
July 25	12	20	265	11	31	500	47.0	
Sept. 8	12	20	305	11	32	470	35.1	41.2
July 28	14	20	260	13	32	470	44.7	
Sept. 12	14	24	300	13	32	455	34.1	39.5
July 28	16	20	220	15	32	430	48.8	
Sept. 12	16	26	305	15	32	460	33.7	41.0
Aug. 1	18	20	240	17	30	435	44.8	
Sept. 15	18	26	325	17	32	475	31.6	37.9

TABLE 2. SUMMARY OF RESULTS OF TESTS FOR 1933

Date Cut	Infested Plots	Height When Cut Inches	Dry Weight Grams	Check Plots	Height When Cut Inches	Dry Weight Grams	Reduction in Yield	
							Cutting Percent	Season Percent
June 2	2	24	555	1	24	540		
July 10	2	15	230	1	26	555	58.6	
Aug. 29	2	21	120	1	30	330	63.6	36.5
June 2	4	24	540	3	24	530		
July 15	4	18	255	3	30	595	57.1	
Sept. 2	4	22	170	3	30	470	63.8	39.5
June 5	6	24	610	5	24	620		
July 20	6	23	310	5	30	690	55.1	
Sept. 5	6	21	260	5	32	545	52.3	36.4
June 5	8	24	605	7	24	610		
July 20	8	23	230	7	30	565	59.3	
Sept. 5	8	21	210	7	32	500	58.0	37.6
June 9	10	25	700	9	25	720		
July 28	10	24	265	9	30	540	50.9	
Sept. 9	10	22	230	9	32	380	39.5	27.1
June 9	12	25	590	11	28	580		
July 28	12	23	275	11	30	575	52.2	
Sept. 9	12	22	280	11	32	410	31.7	26.8
June 13	14	28	570	13	28	580		
July 31	14	20	270	13	32	505	46.5	
Sept. 13	14	20	250	13	30	350	28.6	24.0
June 13	16	28	760	15	28	790		
July 31	16	20	275	15	32	520	47.1	
Sept. 13	16	22	240	15	30	315	23.8	21.5
June 15	18	30	850	17	30	840		
July 31	18	22	290	17	32	560	48.2	
Sept. 16	18	24	265	17	30	355	25.4	19.9

SUMMARY

The most noticeable injury to alfalfa by the leafhopper, *Empoasca fabae,* is the stunting of the plants and yellowing of the leaves. It has generally been recommended to cut alfalfa when it becomes yellowed, but when this recommendation is followed, the yellowing in most cases is only checked temporarily.

The first crop is injured only slightly, if at all, as a rule, but the second and sometimes the third crop is injured severely when the hoppers are present in numbers.

There is no insecticide that can be used economically for controlling the leafhopper in the field, but the injury can be lessened to a considerable extent and be confined mainly to the second crop by cutting the alfalfa at certain periods in the seasonal development of the insect.

Adult hoppers appear on the alfalfa in considerable numbers about June 1, and begin laying their eggs on the first crop of alfalfa. By delaying the first cutting to near full-blooming of the alfalfa, or to June 10 to June 15, many eggs are destroyed in the first crop and there are fewer hoppers on the second crop and less injury.

The hoppers are most numerous on alfalfa about July 25 and decline in number after that date. When alfalfa is cut during the last week of July injury is confined mainly to the second crop and there is very little injury to the third crop.

Experiments prove that there is less loss from leafhopper injury when the first crop is cut when in nearly the full-bloom stage, or on June 10 to June 15, and the second crop during the last week of July. If the alfalfa is not in nearly full-bloom stage on June 15, the cutting should not be delayed longer, because too many young hoppers will be hatched after that date.

The results reported in this bulletin are in agreement with the findings of the Wisconsin Experiment Station.[2]

[2] Graber, L. F., and Sprague, V. G., Alfalfa Yellows. Science, Vol. 78, pp. 385-6. No. 2026, October 27, 1933.